(13)

Publication 13 "JP-A-11-1392"

(13-1)

[0008]

[Means for Solving the Problems]

In order to attain the object, a method of producing single crystal diamond of the present invention according to claim 1 is mainly characterized by comprising using, as a single crystal diamond substrate, a substrate having a major surface and side surfaces consisting of low-index planes to homoepitaxially gas-phase grow single crystal diamond on the substrate and thereby forming single crystal diamond having a large area.

[0009]

In this context, the term "low-index planes" is defined as indicating all of {100}, {110} and {111} surfaces and those forming angles within 5° with respect to these surfaces as well as {311}, {331}, {511}, {551} and {711} surfaces and those forming angles within 1° with respect to these surfaces, according to the Miller index.

[0010]

Thus, a substrate having a major surface and side surfaces consisting of energetically stable low-index planes can be used as a single crystal diamond substrate to thereby stably grow single crystal diamond on the substrate surface. As a result, high-quality single crystal diamond having a large area can be formed.

(13-2)

[0029]

A substrate (hereinafter, referred to as a "prime substrate") 50 shown in Figs. 1(a) and 4(a) was prepared from single crystal diamond of not smaller than 0.5 mm in thickness having an upper surface 50a consisting of a square {100} surface and side surfaces 50a and 50b also consisting of {100} surfaces and loaded onto the substrate holder, which was made of molybdenum, in the microwave CVD apparatus. Homoepitaxial growth was conducted under <100> preferential orientation growth conditions at a growth rate ratio of about $3^{0.5}$, specifically, under conditions involving using methane-hydrogen mixed gas having a methane concentration of 10±0.5% at a pressure in the reaction vessel kept at 140±5 Torr and a substrate temperature kept at 1000±10°C. As a result, diamond grows as shown in Figs. 1(b), 3(a) and 4(b) so that inclined surfaces 51 appear from the lower portions of the side surfaces 50a and 50b of the prime substrate, while abnormal growing parts 11 (see Fig. 4(b)) and

depressed parts 52 appear on four corners of the upper surface and on the upper corner portions of these four corners, respectively.

[0030]

Thereafter, the diamond further grows as shown in Fig. 1(c) without causing abnormal growth on extensions of the {100} side surfaces so that the upper ends of the inclined surfaces 51 reach a position shown by a broken line in Fig. 3(b), that is, the position of the upper major surface 50a of the prime substrate 50.

(13-3)